

Executive Summary:

Research on Readability of the Nemeth Uniform Braille System (NUBS)

This research was conducted during the summer and fall of 2009 by Dr. Robin Wetzel with assistance from William Amos under the auspices of the Braille Authority of North America (BANA).

Purpose:

The Nemeth Uniform Braille System (NUBS) was developed as an experimental code to combine literary, mathematics, and computer codes into one code. Several member organizations of the Braille Authority of North America (BANA) asked BANA to evaluate NUBS for its potential usefulness. The research committee of BANA was charged with this evaluation. Research on readability, that is, how easy a code is to read, was considered one of the essential components of research on the evaluation of any new code and was therefore, included in the research conducted by BANA on the evaluation of NUBS.

As a beginning point of this investigation, the researchers examined NUBS in relation to the current literary code as described in *English Braille American Edition* (EBAE) in order to determine the differences. NUBS contained three types of differences:

1. NUBS incorporated symbols which were already present in the Nemeth Code and with which some readers would be familiar (e.g. dropped numbers, plus and minus signs in math, fraction beginning and ending signs, and the fraction bar);
2. NUBS created some new symbols by adding a cell to an existing symbol (e.g. opening and closing parentheses, slashes in dates, the colon in time, the dollar sign in money, and the "at" (@) sign in web addresses), and
3. NUBS completely changed symbols in some instances (e.g. period and comma in notational mode, decimal point in money, equals sign in math, and the beginning notational mode sign).

Researchers chose to examine the readability of these changes in material that individuals might encounter in everyday reading which would also include reading recipes or reading material on the internet. While many factors can enter into how "readable" a code is, the effect of these three types of changes on reading rate (expressed in characters per second) was selected as the measure of readability.

Participants:

Participants in the readability study were recruited from conventions of the National Federation of the Blind and American Council of the Blind in the summer of 2009. All participants were current braille users. Data from 82 participants were analyzed for readability.

Procedures:

Researchers developed ten character sets (that is, groups of related braille characters) for the reading measures incorporating the fifteen types of different symbols discovered. The 10 characters sets included lower numbers, narrative parentheses, notational period and comma, dates, notational colon, dollar signs and decimals in money, web addresses, simple math equations, simple fractions, and mixed

numbers. Sixty stimuli were created overall with six sentences created for each character set. Three of the sentences were produced in NUBS and three using EBAE. This permitted each type of change to be analyzed separately for its impact on reading rate, as well as for researchers to look at the reading rate for each code overall.

Participants were first given a written explanation of NUBS with a listing of the symbols being studied in both EBAE and NUBS. They had as long as they needed to become familiar with the materials. Most took 10-15 minutes. They were then presented with three instances (sentences) of each measure in each code and were asked to read the stimuli out loud as fast as they could. They were timed during the process to determine a reading rate for each set of stimuli in each code. For each set of stimuli, the first instance read was treated as practice and dropped from the analysis. Performance on the remaining two instances was averaged to obtain a more stable measure of reading rate in characters per second.

Examples of the types of sentences read in NUBS and EBAE are:

During the work week, the 16A bus arrives at 7:45.

Send your order to santa@northpole.com before Christmas.

For tomorrow's lesson read pages 27, 32, and 78.

Analysis:

Characters per second reading rates were analyzed for differences between the NUBS and EBAE stimuli. Stimuli were examined to determine whether including spaces as characters had an impact on the reading rates; using or not using spaces in the determination of the reading rates did not differentiate the results.

For seven of the ten character sets the sentences in NUBS were read more slowly than the sentences in EBAE. For two of the character sets (the dates and web addresses) there was no difference between NUBS and EBAE as far as reading speed. The only character set which resulted in a faster reading rate for NUBS was the set which involved dropped numbers only with no other symbol changes.

Limitations of the research:

It is difficult to anticipate what differences might occur in reading rate if readers had more experience with the NUBS code. This research did not provide extensive training in NUBS. Therefore no conclusion can be reached about whether having experience in reading NUBS would contribute to faster reading rates.

Summary:

At the present time, based upon the research evidence provided here, there does not seem to be any advantage in terms of reading rates of the NUBS code over EBAE.